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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

April 2024 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 22AS3PCTOM **Max Marks: 100**
Course: Theory of Mechanisms

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) Identify and describe the following terms: I) link, ii) lower pair and iii) higher pair. With respect to the mechanism shown in the Fig.1a.

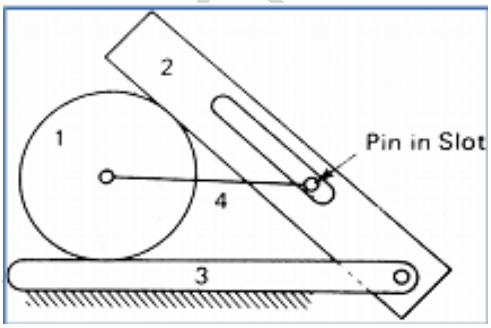

Fig.-1a **6**

b) Explain the following inversions with a neat sketch. Also, state, they are inversions of which mechanism? i) Hand Pump, ii) Oldham's Coupling **14**

UNIT - II

2 a) Explain with neat diagram the Ackermann steering mechanism. **8**

b) Explain with neat diagrams, the difference between Whitworth Quick Return Mechanism and Crank and Slotted Lever Quick Return Mechanism **12**

UNIT - III

3 a) Locate all the instantaneous centers of the slider crank mechanism as shown in Fig 3a. The lengths of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 **12**

rad/s, find i). Velocity of the slider A, and ii). Angular velocity of the connecting rod AB.

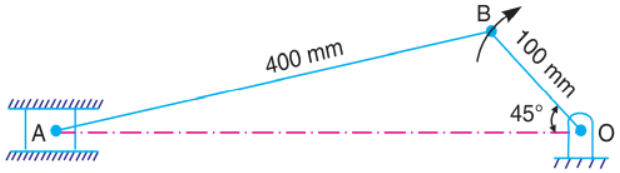

Fig 3a

b) Figure 3b shows a six-link mechanism. The dimensions of the links are: OA = 220 mm, AB = 485 mm, BQ = 310 mm, BC = 590 mm and CD = 400 mm. For the position when the crank OA makes an angle of 60° with the vertical, find the velocity of the slider D. The crank rotates clockwise at 150 rpm.

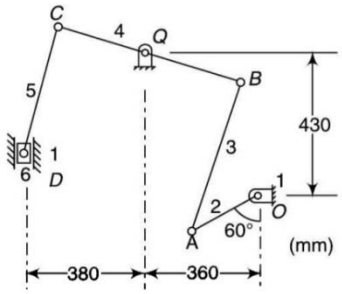

Fig. 3b **8**

UNIT - IV

4 a) The given Fig.-4a shows a toggle mechanism in which the crank OA rotates at 150 rpm clockwise. Find the velocity and the acceleration of the slider at D. Also find the angular acceleration of the links AB, BD and BQ.

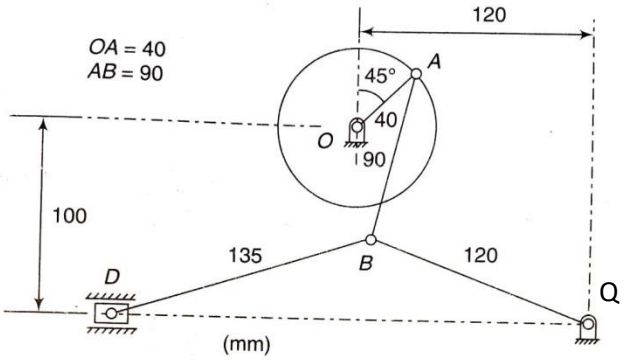

Fig. 4a **14**

b) Draw the velocity and acceleration diagrams for the single slider crank mechanism, having 50 mm crank at an angle of 30° with respect to horizontal, 600 mm connecting rod, provided the crank rotates at 120 rpm clockwise. **6**

OR

5 a) Upon what conditions that a body is subjected to acceleration? Describe and obtain the relationships for different kind of accelerations acting on a moving body, with neat diagrams. **10**

b) A four-bar link has AB=50 mm, BC=66 mm, CD = 56 mm and AD = 100 mm. Link AB is at 60^o to the horizontal and rotates anticlockwise at 10.5 rad/sec. It is also subjected to a retardation of 26 m/s^2. Find the angular accelerations of the links BC and CD. **10**

UNIT - V

6 a) Obtain the relationship for the Coriolis component of acceleration acting on a floating body in a mechanism. **8**

b) Figure 6b given here shows the link mechanism of a quick return mechanism of the slotted lever type, the various dimensions of which are, OA = 400 mm, OP = 200 mm, AR = 700 mm, RS =300 mm. For the configuration of the link shown, determine the acceleration of the cutting tool at S and the angular acceleration of the link RS. The crank OP rotates at 210 rpm (CW).

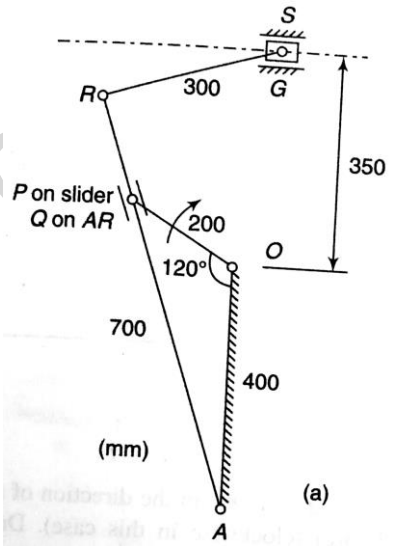

Fig. 6b **12**

OR

7 a) Explain the effect of not considering the Coriolis component of acceleration in the design of mechanisms. **6**

b) For the Whitworth quick return mechanism as shown in Fig. 7b, the determine following when the crank OP has an angular velocity of 2.5 rad/sec and angular deceleration of 20 rad/s^2 at the instant. **14**

i) The acceleration of the slider S,

ii) The angular acceleration of links AR and RS.

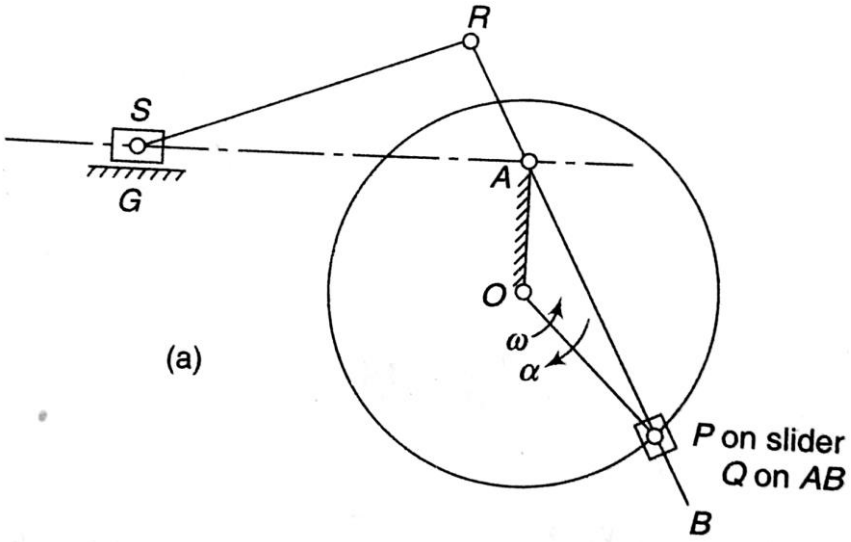

Fig. 7b

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